Keeping Pace with Forage Testing Options?

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Advances in forage fiber testing have been rapid over the past 30 years to keep pace with evolving understanding of nutrient needs of high producing dairy cows. Forage testing today utilizes chemical, physical, and biological tests – all of which need to be correlated with animal digestion or in vivo data.

Thirty years ago chemical tests for crude protein (CP) and crude fiber (CF) were the norm. But CF underestimated high quality forage and overestimated low quality forage, so new chemical fiber tests were developed – Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), Acid Detergent Lignin (ADL). Concurrently, the development of Near Infrared Reflectance Spectroscopy (NIRS) made the use of forage analysis more practical by decreasing the turnaround time and reducing chemistry laboratory costs.

The first pushback to adoption of ADF and NDF was due to the test accuracy within a lab and between labs. So test procedures were standardized and a voluntary testing proficiency program was established to show laboratory performance of DM, CP, ADF and NDF by National Forage Testing Association (NFTA). In addition, the need to standardize NIRS testing has been met within North America by the NIRS Forage and Feed Testing Consortium.

As tests proliferated and the market demanded more information, the need for a Relative Feed Value index (RFV) took center stage. The American Forage and Grassland Council in 1978 recommended the use of RFV, but used fiber tests to predict animal digestion and intake.

As focus turns to higher producing cows, nutrient requirements increase, but tolerances for meeting these needs narrow, requiring more accurate estimates of protein and energy. The biggest limitation to RFV accuracy has been the prediction of fiber digestibility. So biological tests used in research labs with 'artificial rumens' were commercialized to estimate rumen fiber digestion. The tests estimate Neutral Detergent Fiber Digestibility (NDFD), an estimate of fiber digestibility by a single fermentation time (often 24, 30 or 48 hours).

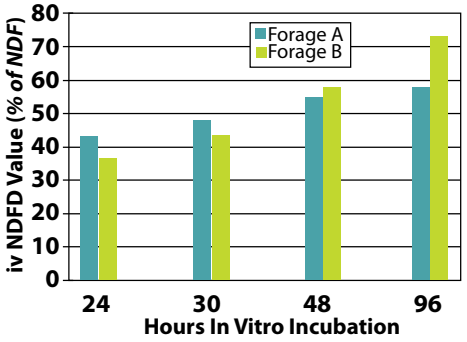
The availability of the NDFD test via NIRS or artificial rumens led to the Relative Forage Quality (RFQ) index which is an improvement over RFV because it uses in vitro NDFD (IVNDFD) at 48 hours to estimate fiber digestibility.

The Newest Methods

New models use fiber content, rate of fiber digestion, and amount of indigestible fiber to reflect rates of passage or 'rumen fill'. In 2013, Rick Grant of the W. H. Miner Agricultural Research Institute proposed a 'final four' of methods that should be used to characterize fiber digestibility: 1) NDF and ratio of lignin/NDF; 2) NDFD rate of digestion by in vitro digestion at 24, 30, or 48 hours; 3) estimate of indigestible fiber by in vitro digestion of NDF at 240 hours or lignin times 2.4 each to estimate dry matter intake; and 4) physically effective fiber by assessing particle size.

IVNDFD analysis of two forages, each containing 40% NDF (shown in Figure 1), demonstrates the need for more than a digestion estimate at a single time point. Forage A is higher than B at 24 and 30 hours and B is higher than A at 48 and 96 hours. A model using in vitro digestion coefficients at 24, 30, and 48 hours, as well as in vitro digestion of NDF at 240 hours to estimate indigestible NDF, enables estimates of potentially digested NDF, the rate of passage, and 'rumen fill.'

Figure 1. NDFD values for forages with similar NDF (40%) after 24, 30, 48, and 96 hours of incubation in buffered rumen fluid.



Source: 2013. TTNDFD: A New Approach To Evaluate Forages. Combs, David K. Cornell Nutrition Conference

University of Wisconsin researchers recently proposed a more direct model of fiber degradation - a total tract digestibility coefficient for NDFD (TTNDFD). The TTNDFD value is benchmarked to fiber digestibility values obtained from feeding trials where NDF digestion has been directly measured. Total tract fiber value is used in equations to predict digestible energy, net energy or TDN. This accounts for ruminal and post-ruminal fiber digestion. In addition, NDFD measurements can be done by in vitro analysis or by NIRS. This test package is offered by Rock River Laboratories, Inc.

Another exciting new laboratory method, Fermentrics™, utilizes a batch-culture, rumen-fluid, gas-fermentation system to differentiate rapid and slowly-fermenting carbohydrate pools of Total Mixed Ration (TMR) samples. Fermentrics™ offers many other parameters including potential microbial protein production. The novel method is offered by Dairyland Laboratories, Inc. and RFS Technologies™.

Bottom line: At a minimum, producers should be using NDFD and RFQ, not RFV, to estimate forage quality. For more precise forage analyses, producers and their nutritionists should be learning about the newest methods mentioned above.

Visit the U.S. Dairy Forage Research Center website to view presentations related to this article: "Have you kept pace with forage testing options" by Neal Martin and "Using forage fiber analyses to get the most from your cows" by Rick Grant (www.ars.usda.gov/mwa/madison/dfrc; click on Publications, then Presentations).